

PRELIMINARY DATA SUMMARY

July 1986

U.S. Army Engineer Waterways Experiment Station  
Coastal Engineering Research Center  
Field Research Facility  
Duck, North Carolina

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CERC Field Research Facility  
Duck, North Carolina

This report provides a summary of basic oceanographic, meteorological and bottom profile data for the month. The data were obtained as part of the Field Research Facility Measurement and Analysis Work Unit at the U.S. Army Engineer Waterways Experiment Station, Coastal Engineering Research Center's Field Research Facility in Duck, North Carolina. The data were collected and the analyses performed by the FRF staff. These summaries are intended to make the data readily available to all FRF users, and comments on their content and usefulness are invited.

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## I. INTRODUCTION

The U.S. Army Engineer Waterways Experiment Station, Coastal Engineering Research Center's (CERC) Field Research Facility (FRF) is located on the Outer Banks of North Carolina, near the village of Duck (Fig.1).

The FRF research program provides a means for obtaining high-quality field data, particularly during storms, in support of the U.S. Army Corps of Engineers' coastal engineering research missions. The FRF consists of a 561-m (1,840 ft) long concrete research pier supported on 0.91 m (3 ft) diameter steel piles. The pier deck is 6.1 m (20 ft) wide, 7.74 m (25.4 ft) above mean sea level (MSL), and extends from behind the dunes to approximately the 7.6 m (25 ft) depth contour. In addition, a main building contains offices, an instrument repair shop, and a data acquisition room.

One of the responsibilities of the FRF research program is the collection, analysis and dissemination of data on local oceanographic and meteorological conditions. Bottom profiles along both sides of the pier and periodic bathymetric surveys are also performed.

This summary is intended to provide basic data as soon as possible after they are obtained. Most of the data are daily observations or the results of preliminary data analysis. In many instances, continuous analog records and more extensive analyses will be made available later by the CERC Coastal Engineering Information and Analysis Center (CEIAC).

Table 1 is a list of instruments used, their status during the month, and the data collection status. Figure 2 identifies the location of the instruments. The water depth at the wave gages and current meters vary and may best be determined from the information contained in Figure 8. Other installation information is contained in Table 1. All times unless otherwise specified are referenced to Eastern Standard Time (EST).

Section II presents the meteorological data; Sections III through VI, oceanographic data; Section VII, nearshore profiles and bathymetry; and Section VIII, if included, documents special events that occurred at the FRF during the month.

Questions and/or comments concerning the data may be directed to Mr. Herman C. Miller at (919) 261-3511.

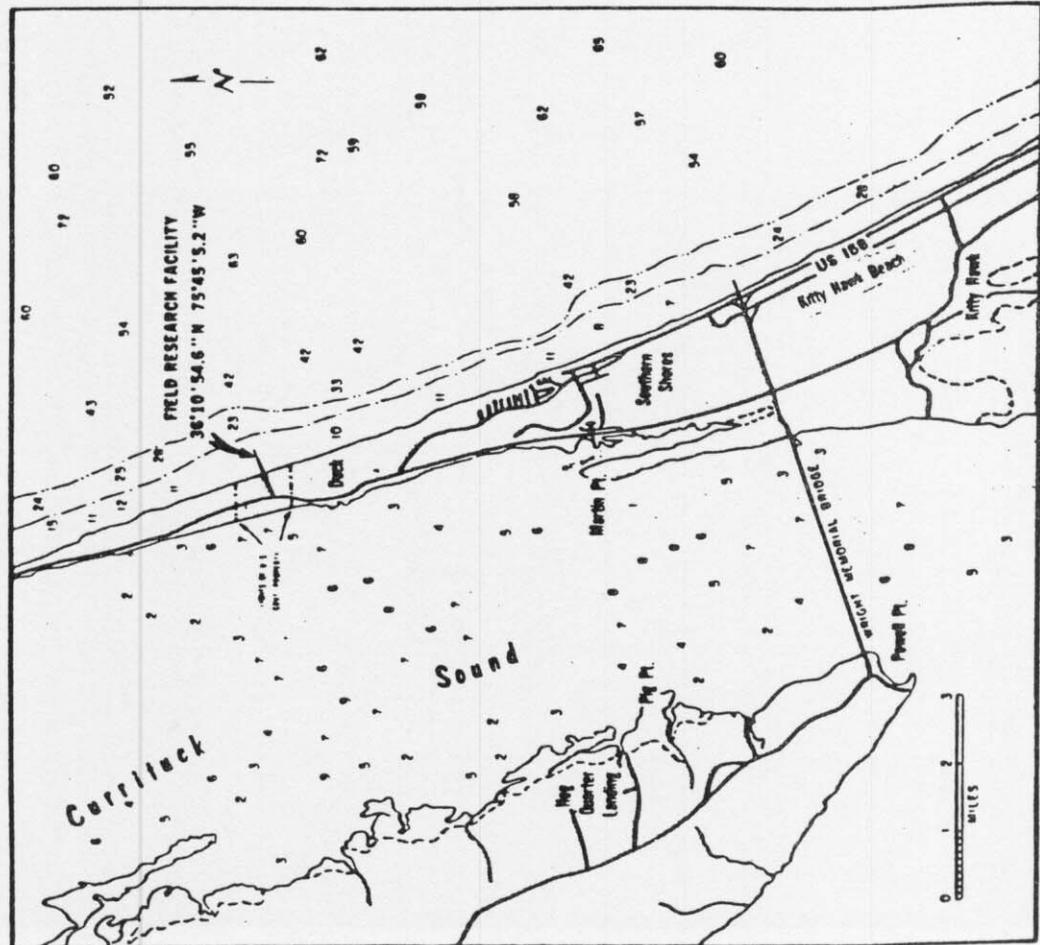
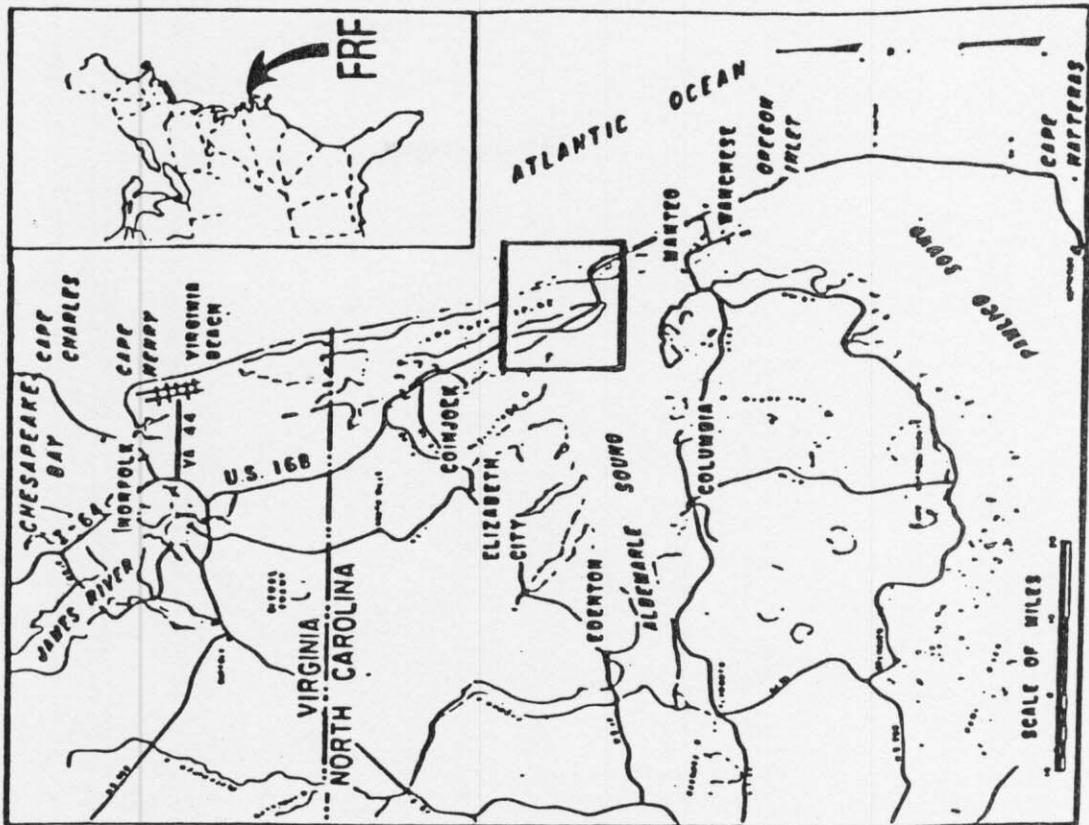


Figure 1. FRF Location Map



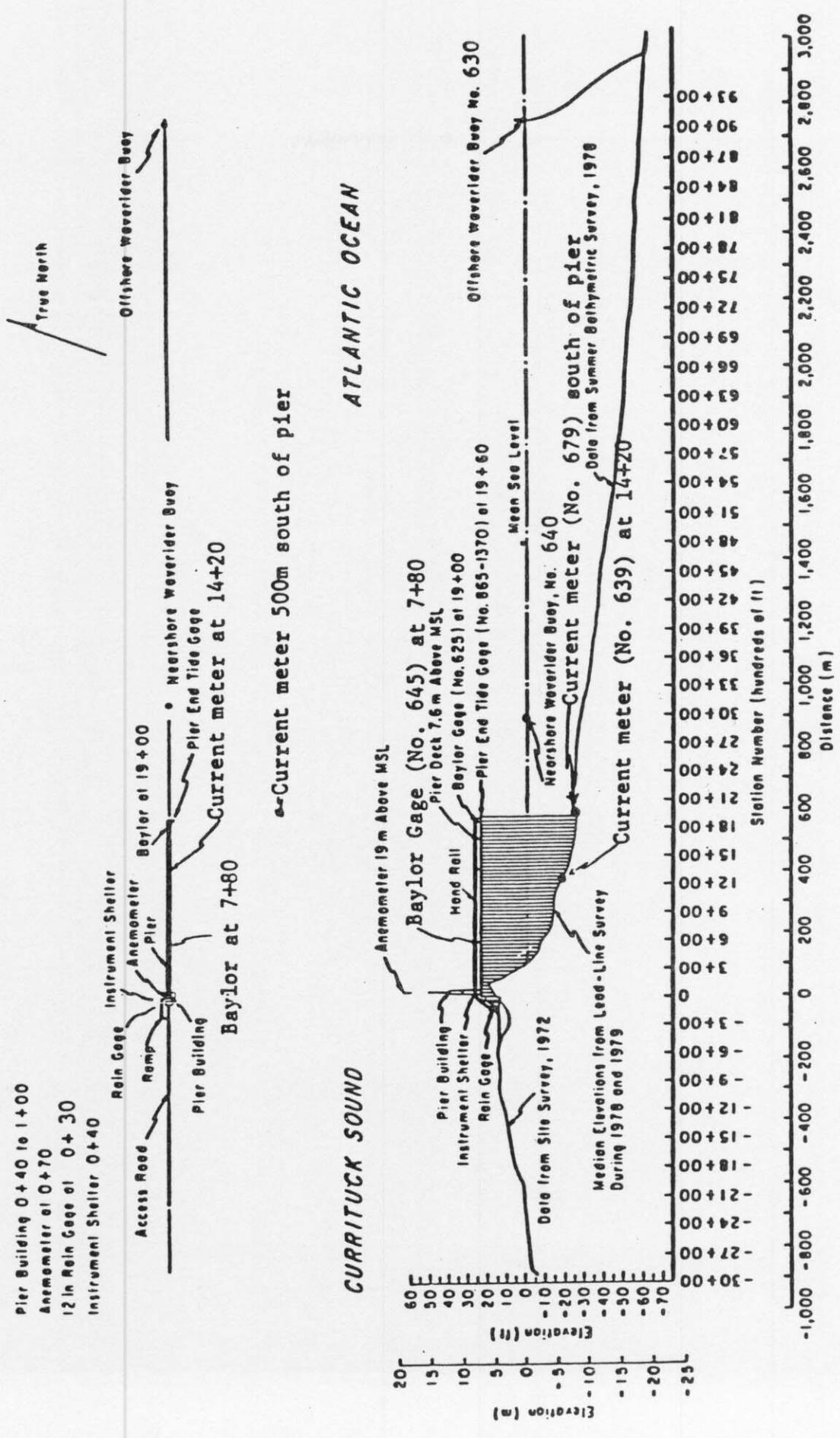


Figure 2. Instrument locations at FRF.

## II. METEOROLOGICAL DATA

A variety of instruments have been installed at the FRF (Fig. 2) to monitor the meteorological conditions. The data presented in Table 2 are collected and stored on magnetic tape using a Data General NOVA-4 computer. For each instrument identified in Table 1 as having analog outputs, chart records are obtained, a log is maintained and the records are stored for future reference.

The wind measurements are obtained from a Weather Measure Skyvane located on the FRF laboratory building (Fig. 2), 19.1 m above mean sea level (MSL).

The high and low temperatures are obtained from daily readings of NWS maximum and minimum thermometers and represent the extreme temperature values since the last reading.

The following may be useful for converting the data in Table 2 to other frequently used units of measurement:

1. Millimeters (mm) to inches (in) -  
 $\text{mm} \times .03937 = \text{in}$
2. Millibars (mb) to inches of mercury (in Hg) -  
 $\text{mb} \times 0.02953 = \text{in Hg}$
3. Degrees Celcius (C) to degrees Fahrenheit (F) -  
 $(\text{C} \times 9/5) + 32 = \text{F}$
4. Meters per second (m/s) to knots (kn) -  
 $\text{m/s} \times 1.943 = \text{kn}$

TABLE 2: METEOROLOGICAL DATA

PART 1

JULY 1956

DAY	HOUR	WIND SPEED (M/S)	WIND DIRECTION (DEG TN)	TEMPERATURE (DEG C)	ATM PRESSURE (MB)	PRECIPITATION (MM)
1	100	3	191	24.1	1013.9	0
	700	5	28	22.4	1015.7	0
	1300	5	53	24.3	1017.0	0
	1900	2	124	24.8	1014.9	0
2	100	7	215	26.0	1012.4	0
	700	10	236	26.7	1009.6	0
	1300	8	230	31.4	1007.6	0
	1900	7	217	24.7	1006.8	10
3	100	7	262	23.9	1007.7	0
	700	5	348	22.6	1009.0	0
	1300	5	46	24.0	1012.5	0
	1900	2	77	23.9	1015.2	0
4	100	1	124	20.2	1018.2	0
	700	2	14	23.8	1021.6	0
	1300	5	101	27.2	1022.6	0
	1900	5	154		1022.2	0
5	100	4	172		1022.9	0
	700	3	147	Cable Problem	1024.3	0
	1300	5	122		1024.3	0
	1900	6	99		1023.6	0
6	100	3	209		1023.2	0
	700	3	281		1024.9	0
	1300	4	225	31.4	1023.6	0
	1900	5	189	29.1	1022.6	0
7	100	5	236	26.9	1022.2	0
	700	6	271	27.5	1022.6	0
	1300	2	137	34.9	1020.5	0
	1900	2	161	27.6	1018.8	0
8	100	6	265	28.4	1018.5	0
	700	5	308	28.7	1018.8	0
	1300	3	40	30.1	1018.5	0
	1900	4	145	27.2	1014.4	0
9	100	4	230	28.3	1014.4	0
	700	6	242	28.7	1013.4	0
	1300	6	233		1011.7	0
	1900	6	217		1009.7	0
10	100	7	286	Cable Problem	1011.7	0
	700	5	348		1014.1	0
	1300	3	93		1015.8	0
	1900	6	144		1015.1	6
11	100	4	210		1014.1	0
	700	4	284		1014.8	0
	1300	0			1013.8	0
	1900	2	229		1014.1	0
12	100	5	221		1014.1	22
	700	6	239		1014.1	0
	1300	5	233		1014.4	0
	1900	8	223		1013.4	0
13	100	7	229		1015.1	0
	700	8	254		1015.5	0
	1300	5	209		1015.1	0
	1900	7	215		1014.8	0
14	100	7	233		1015.8	0
	700	8	300		1017.2	0
	1300	3	117		1018.5	0
	1900	5	229		1017.2	0
15	100	7	237		1017.5	0
	700	5	53		1017.2	0
	1300	4	69		1020.2	0
	1900	2	72		1019.5	0
16	100	3	83		1019.8	0
	700	3	100		1020.3	0
	1300	5	100		1020.6	0
	1900	4	150		1019.2	0

TABLE 2: METEOROLOGICAL DATA

PART 2

JULY 1986

DAY	HOUR	WIND SPEED (M/S)	WIND DIRECTION (DEG TN)	TEMPERATURE (DEG C)	ATM PRESSURE (MB)	PRECIPITATION (MM)
17	100	7	233		1018.6	0
	700	6	256		1018.3	0
	1300	3	45		1018.9	0
	1900	3	129	Cable Problem	1017.4	0
18	100	2	119		1017.2	0
	700	1	353		1016.4	0
	1300	2	57		1015.5	0
	1900	3	131		1013.6	0
19	100	2	290		1012.8	0
	700	3	117		1012.8	0
	1300	5	118		1011.7	0
	1900				1010.7	17
20	100		Software Crash		1011.1	0
	700	3	60		1012.4	0
	1300	3	65		1012.4	0
	1900	5	140		1011.4	0
21	100	9	334		1012.4	18
	700	7	2		1013.4	0
	1300	4	52		1014.8	0
	1900	3	103		1015.5	0
22	100	2	163		1017.5	0
	700	4	76		1018.9	0
	1300	4	103		1019.9	6
	1900	5	124		1020.5	0
23	100	6	139		1020.9	0
	700	3	37		1019.5	6
	1300	4	109	27.4	1020.1	0
	1900	6	93	26.8	1019.5	0
24	100	5	108	26.4	1020.2	0
	700	6	98	27.2	1020.2	0
	1300	6	75	26.0	1020.9	0
	1900	7	133	27.3	1019.2	0
25	100	4	139	25.1	1019.1	0
	700	5	246	25.6	1018.7	8
	1300	5	172	25.2	1018.8	3
	1900	5	159	25.1	1016.6	0
26	100	5	213	26.8	1017.2	0
	700	5	202	27.3	1016.5	0
	1300	5	213		1015.5	0
	1900	5	217	28.0	1013.8	0
27	100	5	202	26.4	1013.4	0
	700	3	246	26.9	1012.4	0
	1300	3	122	29.1	1012.1	0
	1900	3	264	29.8	1010.7	0
28	100	6	232	27.8	1011.1	0
	700	4	267	27.0	1010.0	0
	1300	5	257	30.9	1009.4	0
	1900	1	340	28.2	1009.0	0
29	100	6	230	28.5	1010.0	0
	700	7	242	27.2	1010.4	0
	1300	5	234	31.9	1008.4	0
	1900	10	228	26.3	1007.7	0
30	100	8	268	25.6	1008.4	0
	700	4	328	24.9	1009.7	0
	1300	3	65	27.6	1009.7	0
	1900	2	124		1010.0	0
31	100	2	169	Cable Problem	1011.1	0
	700	3	344		1011.4	0
	1300	3	76		1012.1	0
	1900	5	147		1012.8	0

### III. WAVE DATA

Wave data were collected from two Baylor staff gages (CERC gage Nos. 625 and 645) and Waverider buoys (CERC gage Nos. 630 and 640, Table 1 and Figure 2). The data were collected, analyzed, and stored on magnetic tape using a Data General NOVA-4 computer.

The NOVA-4 is programmed to sample the wave gages every 6 hours near 0100, 0700, 1300, and 1900 EST at a sampling rate of four times per second, collecting data in 20-minute records.

Wave height (H<sub>m0</sub>) is an energy-based statistic equal to four times the standard deviation of the sea surface elevations. The wave period is identified from the computation of a variance (energy) spectrum using a Fast Fourier Transform of 4096 data points (1024 sec). The period (T<sub>p</sub>) is that associated with the maximum energy density in the spectrum. When this analysis is complete, the data are written to magnetic tape and entered into the CERC data base.

Table 3 presents the wave heights and periods for each wave record obtained during the month. The monthly means shown in Table 3 are an average of the values computed for all data records collected. The monthly standard deviations are standard deviations from the monthly mean of values for each record.

Figure 3 is a time history of the H<sub>m0</sub> and T<sub>p</sub> values for the Waveriders, 6 km from shore (630) and 1 km from shore (640).

Differences in wave periods between wave gages (Table 4 and Figure 3) may be due to wave breaking or reformation, or the presence of multiple wave trains containing nearly equal energy.

TABLE 3: WAVE DATA

PART 1

JULY 1986

GAGE DAY TIME	645 Baylor at 7+80 Hmo(m) T(sec)		625 Baylor at 19+00 Hmo(m) T(sec)		640 Nearshr Wvrd Hmo(m) T(sec)		630 Farshr Wvrd Hmo(m) T(sec)	
	1 1					.58	8.83	.66
7					.48	9.75	.59	8.83
13	.49	3.95			.71	4.76	.78	8.83
19	.54	5.02	<u>Gage Inoperative</u>		.63	4.53	.78	5.31
2 1	.45	8.83			.61	5.99	.72	5.99
7	.32	8.83			.47	9.75	.75	8.83
13	.40	6.87			.32	8.83	.71	6.40
19	.37	9.75			.39	8.83	.73	5.31
3 1	.33	8.83			.42	7.42	.64	7.42
7	.44	7.42			.47	7.42	.55	14.22
13	.69	3.79			.64	3.64	.72	4.13
19	.49	4.53			.61	8.83	.62	4.76
4 1	.42	4.32			.45	9.75	.56	4.76
7	.43	4.76			.46	12.34	.52	5.99
13		*			.50	8.06	.57	8.06
19	.46	8.06				*		*
5 1	.52	5.63			.59	7.42	.66	7.42
7	.47	7.42			.53	7.42	.67	6.40
13	.58	8.06			.52	6.87	.63	8.83
19	.46	8.83			.52	8.06	.68	8.06
6 1	.62	8.83			.56	7.42	.67	8.06
7	.39	8.83			.47	8.83	.62	8.06
13	.51	8.06			.46	8.06	.50	8.83
19	.40	8.83			.47	8.83	.58	8.83
7 1	.49	8.83			.44	8.83	.55	8.06
7	.32	7.42			.42	7.42	.55	8.06
13	.35	7.42			.39	8.06	.44	8.06
19	.33	8.06			.44	8.83	.44	8.83
8 1	.30	8.83			.39	8.83	.46	8.06
7	.24	8.06			.40	8.06	.40	8.06
13	.30	9.75			.38	8.06	.39	8.83
19	.32	9.75			.41	8.83	.41	8.06
9 1	.29	8.06			.33	9.75	.42	8.83
7	.27	8.06			.35	9.75	.42	8.83
13	.25	8.06			.29	8.06	.38	8.83
19	.27	8.83			.34	8.83	.48	8.83
10 1	.31	4.76			.41	8.83	.41	7.42
7	.36	7.42			.43	2.78	.53	8.06
13	.49	4.13			.56	3.95	.55	3.95
19	.49	6.87			.55	4.53	.59	8.06
11 1	.34	7.42			.36	8.83	.48	5.63
7					.25	8.06	.38	8.06
13								
19								
12 1	Electronic Problems							
7	Electronic Problems							
13	Electronic Problems							
19	Electronic Problems							
13 1	Electronic Problems							
7	Electronic Problems							
13	Electronic Problems							
19	Electronic Problems							
14 1	Electronic Problems							
7	Electronic Problems							
13	Electronic Problems							
19	Electronic Problems							
15 1	Electronic Problems							
7	Electronic Problems							
13	Electronic Problems							
19	Electronic Problems							
16 1	Electronic Problems							
7	Electronic Problems							
13	Electronic Problems							
19	Electronic Problems							

\*=Electronic Problems

TABLE 3: WAUL DATA

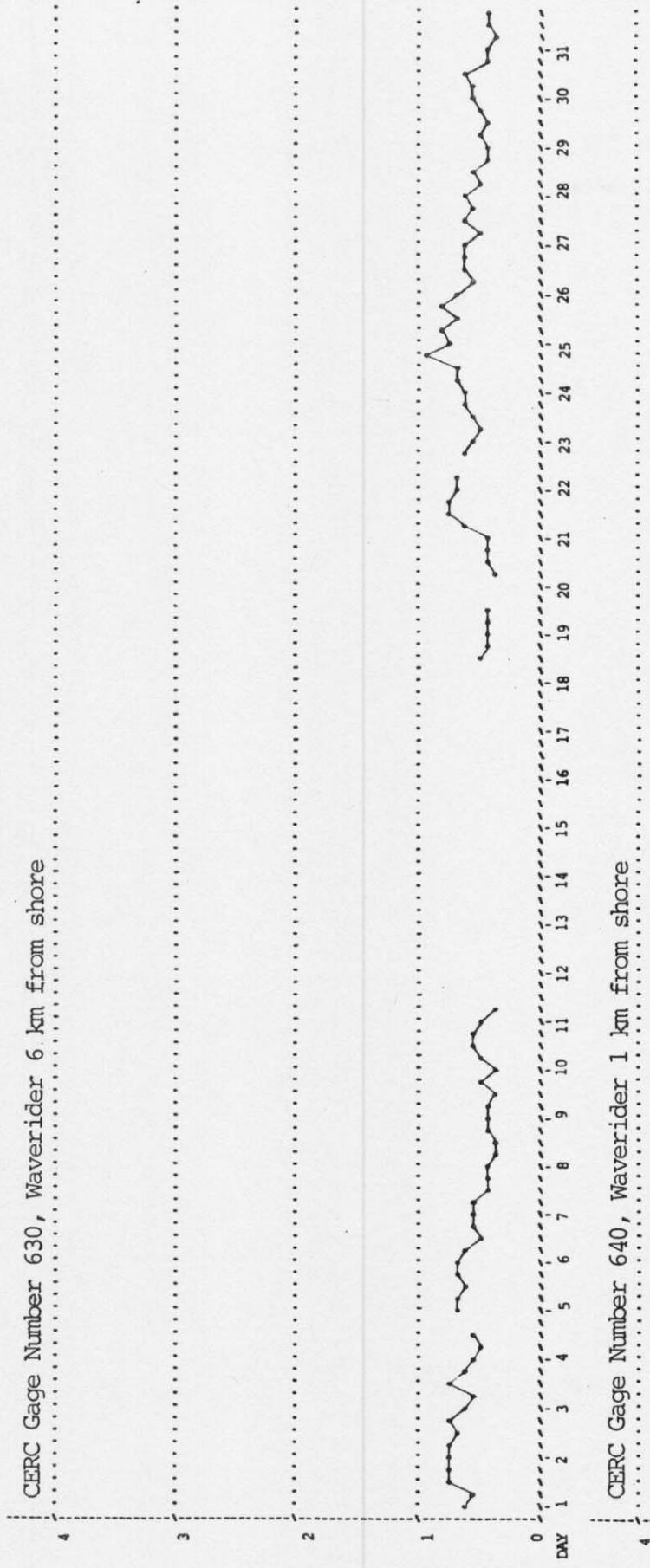
PART 2

JULY 1986

DAY	GAGE TIME	645 Baylor at 7+80		625 Baylor at 19+00		640 Near shr Wvrd		630 Far shr Wvrd		
		Hmo(m)	T(sec)	Hmo(m)	T(sec)	Hmo(m)	T(sec)	Hmo(m)	T(sec)	
17	1									
	7									
	13									
	19									
18	1	.30	8.06							
	7		*	<u>Gage Inoperative</u>						
	13					.38	8.83	.40	12.34	
	19	.31	8.06			.37	8.06	.43	8.83	
19	1	.24	10.89			.31	12.34	.41	8.83	
	7	.36	7.42			.38	10.89	.44	12.34	
	13	.30	7.42			.36	7.42	.42	10.89	
	19									
20	1		*				*		*	
	7	.36	7.42			.41	10.89	.39	8.06	
	13	.41	3.64			.40	10.89	.45	10.89	
	19	.43	6.87			.44	8.06	.46	6.87	
21	1	.47	4.32			.41	8.83	.44	8.06	
	7	.53	12.34			.65	10.89	.64	10.89	
	13	.66	8.06			.71	12.34	.74	9.75	
	19	.56	12.34			.80	12.34	.78	8.83	
22	1	.56	10.89			.74	10.89	.69	10.89	
	7	.42	9.75			.69	8.83	.71	9.75	
	13		*				*		*	
	19	.47	7.42			.59	8.83	.61	8.83	
23	1	.53	6.87			.54	8.83	.57	9.75	
	7	.40	6.40			.49	7.42	.50	7.42	
	13	.49	5.63				*	.57	6.40	
	19	.55	7.42			.58	8.06	.61	5.63	
24	1	.58	4.53			.60	3.51	.63	3.15	
	7	.69	4.13			.67	3.64	.69	5.99	
	13		*			.69	4.13	.71	4.32	
	19	.65	5.02			.79	4.13	.94	5.02	
25	1	.56	6.87			.67	7.42	.75	8.06	
	7	.55	6.87			.64	3.95	.79	7.42	
	13	.52	8.06			.53	8.83	.66	6.87	
	19	.54	4.53			.61	8.06	.79	4.13	
26	1	.49	8.06			.52	8.06	.68	8.83	
	7	.48	5.31			.48	8.83	.53	8.83	
	13	.53	8.06			.56	8.06	.65	8.06	
	19	.63	4.53			.55	8.83	.63	8.06	
27	1	.54	4.53			.52	7.42	.65	8.06	
	7	.58	8.06				*	.51	8.06	
	13					.48	8.06	.60	8.83	
	19					.41	8.83	.57	8.83	
28	1		*			.47	9.75	.60	8.83	
	7					.44	8.83	.53	8.06	
	13					.45	8.83	.55	8.06	
	19	.30	6.40			.40	8.83	.44	8.06	
29	1	.35	5.99			.37	4.76	.45	8.06	
	7	.36	7.42			.35	6.40	.48	7.42	
	13	.40	5.99			.40	6.40	.45	6.87	
	19	.35	6.87			.42	14.22	.48	8.06	
30	1	.29	6.87			.34	7.42	.56	6.40	
	7	.52	6.87			.44	6.87	.56	6.40	
	13	.49	4.32			.49	6.87	.61	4.13	
	19	.43	4.32			.38	4.32	.43	7.42	
31	1	.44	4.32			.38	8.83	.43	6.40	
	7	.29	4.53			.32	7.42	.35	6.87	
	13	.33	7.42			.33	8.06	.43	7.42	
	19	.40	6.40			.40	6.87	.46	6.40	
	MEAN	.44	7.09			.48	8.10	.56	7.86	
	STD	.11	1.95			.12	2.24	.12	1.93	

\*=Electronic Problems

CERC Gage Number 630, Waverider 6 km from shore



CERC Gage Number 640, Waverider 1 km from shore

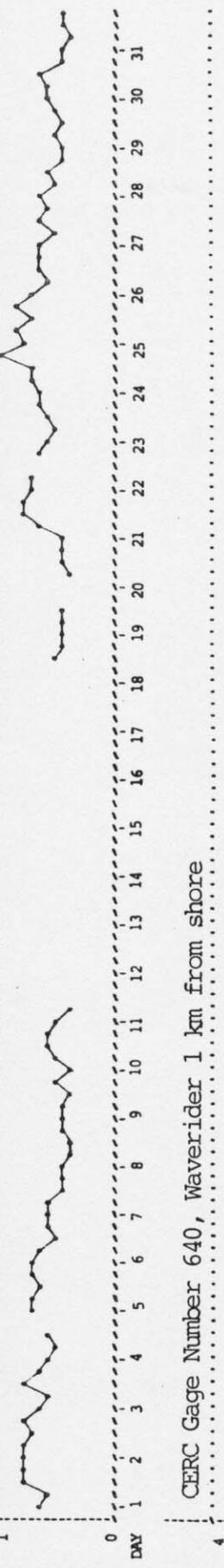
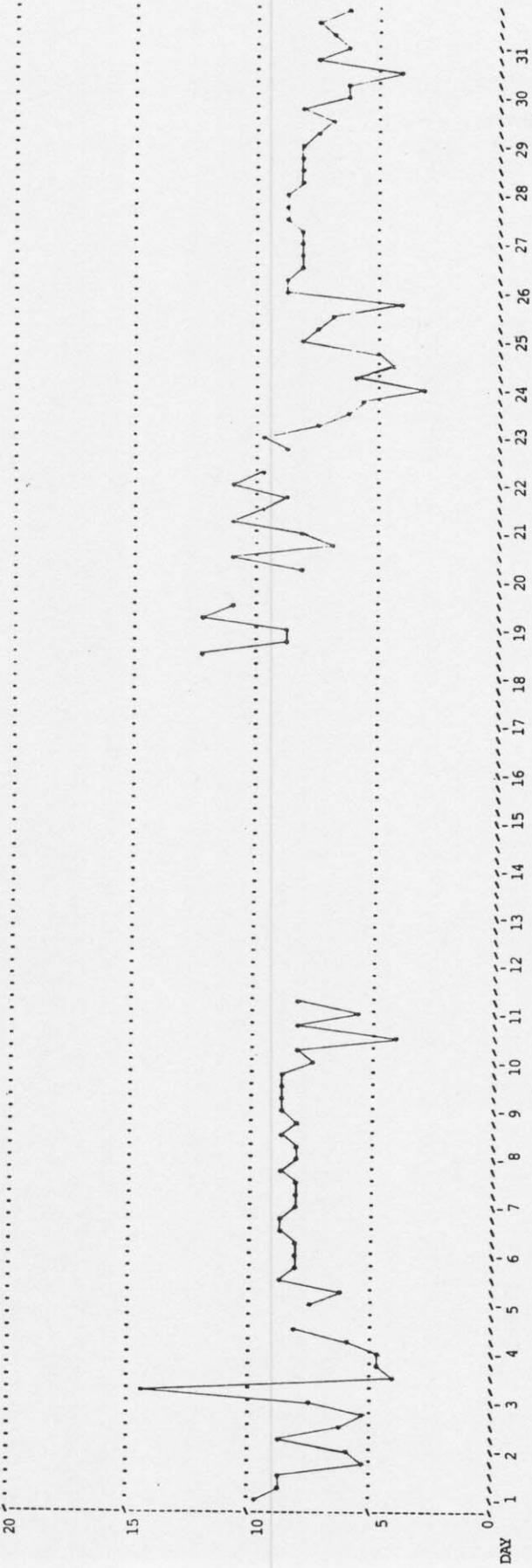


FIGURE 3. Time History of Wave Heights and Periods - July 1986

Part II: Heights

CERC Gage Number 630, Waverider 6 km from shore



CERC Gage Number 640, Waverider 1 km from shore

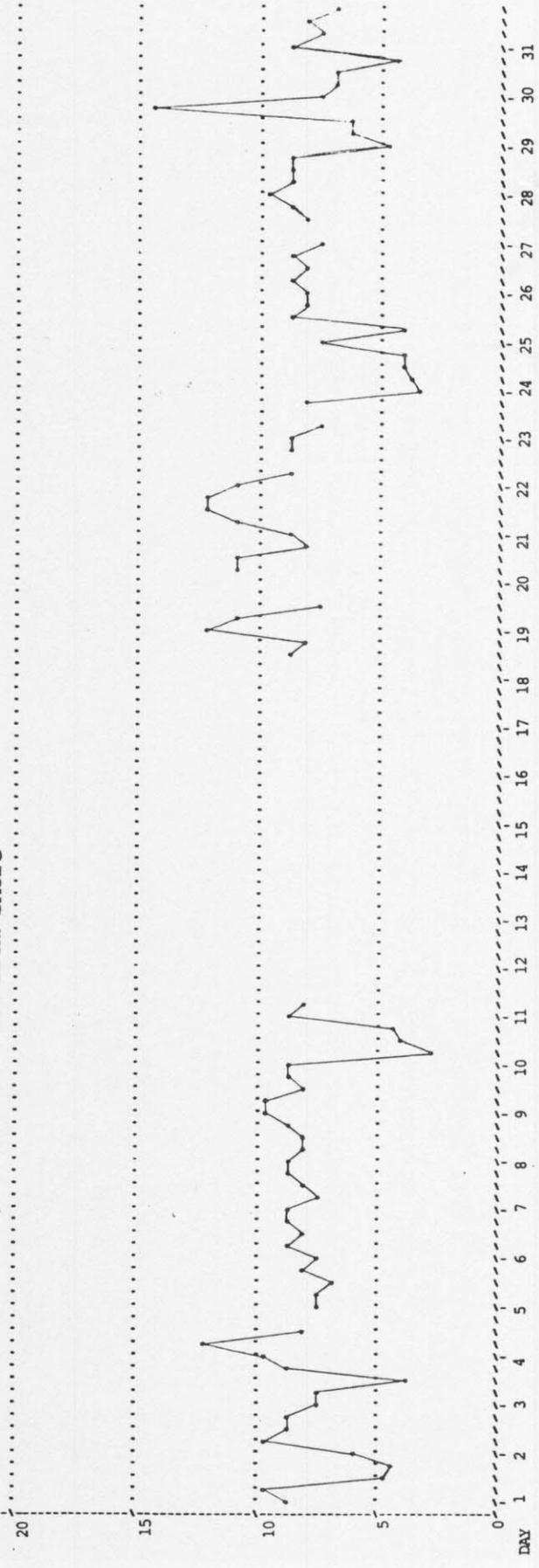


FIGURE 3. Time History of Wave Heights and Periods - July 1986

Part II: Period

#### IV. CURRENT DATA

Current data (Table 4) are collected from two Marsh-McBirney electromagnetic biaxial current meters (Table 1 and Figure 2) and by visually observing the movement of dye on the water surface in the surf and at the seaward end of the pier, as well as 500 m updrift of the pier 12 m offshore.

Since the shoreline orientation is approximately N20W, alongshore currents flow either toward 340 (i.e. northward) or toward 160 (i.e. southward). Similarly, cross-shore currents are either onshore (westward) or offshore (eastward).

All current speeds are given in centimeters per second.

TABLE 4: CURRENT DATA  
(SPEEDS IN CM/SEC)  
July 1986

DAY:	TIME	PIEB MEASUREMENTS				BEACH MEASUREMENTS (500 UPDRIFT)							
		DYE AT 19400 (579m) (SURFACE)		CURRENT METER AT 14120 (433m) I.D.#639 (DEPTH -4.2m MSL)		DYE AT MID-CURF ZONE (SURFACE) DIST. FROM		DYE 12M OFFSHORE (SURFACE)		CURRENT METER AT SOUTH TRIPOD (DEPTH -4.8m MSL) I.D.#679			
		SPEED	DIR	SPEED	DIR	BASELINE(M)	SPEED	DIR	LOCATION	SPEED	DIR	SPEED	DIR
1	0100	Alongshore											
		Cross-shore											
		Resultant											
1	0700	Alongshore	12	S			34	S		45	S		
		Cross-shore	5	On		128	10	On	North				
		Resultant	13	184			35	177					
1	1300	Alongshore											
		Cross-shore											
		Resultant											
1	1900	Alongshore											
		Cross-shore											
		Resultant											
2	0100	Alongshore											
		Cross-shore											
		Resultant											
2	0700	Alongshore	6	N			55	N		55	N		
		Cross-shore	14	Off		128	6	Off	South				
		Resultant	15	47			56	346					
2	1300	Alongshore											
		Cross-shore											
		Resultant											
2	1900	Alongshore											
		Cross-shore											
		Resultant											
3	0100	Alongshore											
		Cross-shore											
		Resultant											
3	0700	Alongshore	18	S			23	N		64	S		
		Cross-shore	3	On		128	12	On	North				
		Resultant	19	169			26	313					
3	1300	Alongshore											
		Cross-shore											
		Resultant											
3	1900	Alongshore											
		Cross-shore											
		Resultant											
4	0100	Alongshore											
		Cross-shore											
		Resultant											
4	0700	Alongshore	30	S			10	N		23	N		
		Cross-shore	6	On		140	3	On	South				
		Resultant	31	171			10	323					
4	1300	Alongshore											
		Cross-shore											
		Resultant											
4	1900	Alongshore											
		Cross-shore											
		Resultant											
5	0100	Alongshore											
		Cross-shore											
		Resultant											
5	0700	Alongshore	13	N			47	N		65	S		
		Cross-shore	5	Off		128	0	0	South				
		Resultant	14	2			47	340					
5	1300	Alongshore											
		Cross-shore											
		Resultant											
5	1900	Alongshore											
		Cross-shore											
		Resultant											
6	0100	Alongshore											
		Cross-shore											
		Resultant											
6	0700	Alongshore	5	N			47	N		58	N		
		Cross-shore	3	Off		128	14	Off	South				
		Resultant	6	15			49	357					
6	1300	Alongshore											
		Cross-shore											
		Resultant											
6	1900	Alongshore											
		Cross-shore											
		Resultant											

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PIER MEASUREMENTS

BEACH MEASUREMENTS  
(500 UPDRIFT)

DAY	TIME	PIER MEASUREMENTS				BEACH MEASUREMENTS					
		SPEED	DIR	SPEED	DIR	BASELINE (M)	SPEED	DIR	LOCATION	SPEED	DIR
		DYE AT 19:00 (579m) (SURFACE)	CURRENT METER AT 14:20 (433m) I.D.#639 (DEPTH -4.2m MSL)	DYE AT MID-SURF ZONE (SURFACE) DIST. FROM			DYE 12M OFFSHORE (SURFACE)	CURRENT METER AT SOUTH TRIPOD (DEPTH -4.8m MSL) I.D.#670			
7	0100	Alongshore									
		Cross-shore									
		Resultant									
7	0700	Alongshore	7 S		128	36 N		35 N	South		
		Cross-shore	15 Off			9 On					
		Resultant	17 94			37 326					
7	1300	Alongshore									
		Cross-shore									
		Resultant									
7	1900	Alongshore									
		Cross-shore									
		Resultant									
8	0100	Alongshore									
		Cross-shore									
		Resultant									
8	0700	Alongshore	41 S		128	23 N		19 N	South		
		Cross-shore	6 On			6 Off					
		Resultant	41 169			24 354					
8	1300	Alongshore									
		Cross-shore									
		Resultant									
8	1900	Alongshore									
		Cross-shore									
		Resultant									
9	0100	Alongshore									
		Cross-shore									
		Resultant									
9	0700	Alongshore	12 N		128	44 N		6 N	South		
		Cross-shore	7 S			7 Off					
		Resultant	14 13			44 349					
9	1300	Alongshore									
		Cross-shore									
		Resultant									
9	1900	Alongshore									
		Cross-shore									
		Resultant									
10	0100	Alongshore									
		Cross-shore									
		Resultant									
10	0700	Alongshore	5 S		128	24 S		15 S	North		
		Cross-shore	1 On			15 On					
		Resultant	5 177			28 191					
10	1300	Alongshore									
		Cross-shore									
		Resultant									
10	1900	Alongshore									
		Cross-shore									
		Resultant									
11	0100	Alongshore									
		Cross-shore									
		Resultant									
11	0700	Alongshore	3 N		128	25 N		7 N	South		
		Cross-shore	0 0			4 On					
		Resultant	3 340			26 331					
11	1300	Alongshore									
		Cross-shore									
		Resultant									
11	1900	Alongshore									
		Cross-shore									
		Resultant									
12	0100	Alongshore									
		Cross-shore									
		Resultant									
12	0700	Alongshore	11 N		129	24 N		6 N	South		
		Cross-shore	2 Off			0 0					
		Resultant	11 349			24 340					
12	1300	Alongshore									
		Cross-shore									
		Resultant									
12	1900	Alongshore									
		Cross-shore									
		Resultant									

Meter Inoperative

Meter Inoperative

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		PIER MEASUREMENTS						BEACH MEASUREMENTS (500 UPDRIFT)					
		DYE AT 19400 (579m) (SURFACE)		CURRENT METER AT 14+20(433m) I.D.#639 (DEPTH -4.2m MSL)		DYE AT MID-SURF ZONE (SURFACE) DIST. FROM		DYE 12M OFFSHORE (SURFACE)		CURRENT METER AT SOUTH TRIPOD (DEPTH -4.8m MSL) I.D.#675			
DAY	TIME	SPEED	DIR	SPEED	DIR	BASELINE(M)	SPEED	DIR	LOCATION	SPEED	DIR	SPEED	DIR
13	0100	Alongshore											
		Cross-shore											
		Resultant											
13	0700	Alongshore	7	S			0	0		3	S		
		Cross-shore	2	Off		152	0	0	North				
		Resultant	8	146									
13	1300	Alongshore											
		Cross-shore											
		Resultant											
13	1900	Alongshore											
		Cross-shore											
		Resultant											
14	0100	Alongshore											
		Cross-shore											
		Resultant											
14	0700	Alongshore	18	S			27	N		0	0		
		Cross-shore	10	On		140	16	On	South				
		Resultant	21	189			31	309					
14	1300	Alongshore											
		Cross-shore											
		Resultant											
14	1900	Alongshore											
		Cross-shore											
		Resultant											
15	0100	Alongshore											
		Cross-shore											
		Resultant											
15	0700	Alongshore	29	S			11	S		46	S		
		Cross-shore	13	On		152	4	On	North				
		Resultant	31	184			12	179					
15	1300	Alongshore											
		Cross-shore											
		Resultant											
15	1900	Alongshore											
		Cross-shore											
		Resultant											
16	0100	Alongshore											
		Cross-shore											
		Resultant											
16	0700	Alongshore	11	S			23	N		34	N		
		Cross-shore	5	On		152	6	On	South				
		Resultant	12	184			23	326					
16	1300	Alongshore											
		Cross-shore											
		Resultant											
16	1900	Alongshore											
		Cross-shore											
		Resultant											
17	0100	Alongshore											
		Cross-shore											
		Resultant											
17	0700	Alongshore	3	S			12	N		18	N		
		Cross-shore	1	Off		152	3	On	South				
		Resultant	3	138			13	326					
17	1300	Alongshore											
		Cross-shore											
		Resultant											
17	1900	Alongshore											
		Cross-shore											
		Resultant											
18	0100	Alongshore											
		Cross-shore											
		Resultant											
18	0700	Alongshore	0	0			6	N		11	N		
		Cross-shore	5	Off		152	2	Off	South				
		Resultant	5	70			6	357					
18	1300	Alongshore											
		Cross-shore											
		Resultant											
18	1900	Alongshore											
		Cross-shore											
		Resultant											

Meter Inoperative

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 OF=OFFSHORE

PIER MEASUREMENTS

BEACH MEASUREMENTS:  
(500 UFDRIFT)

DAY:	TIME	CURRENT METER				DYE AT MID-SURF ZONE				DYE				CURRENT METER			
		SPEED	DIR	SPEED	DIR	BASELINE(M)	SPEED	DIR	LOCATION	SPEED	DIR	SPEED	DIR	SPEED	DIR		
		DYE AT 19+00 (579m) (SURFACE)		CURRENT METER AT 14+20(433m) I.D.#639 (DEPTH -4.2m MSL)		DYE AT MID-SURF ZONE (SURFACE) DIST. FROM		DYE 12M OFFSHORE (SURFACE)		CURRENT METER AT SOUTH TRIPOD (DEPTH -4.8m MSL) I.D.#679							
19	0100	Alongshore															
		Cross-shore															
		Resultant															
19	0700	Alongshore	27	S													
		Cross-shore	5	On				140	8	N			5	N			
		Resultant	27	171					2	On		North					
19	1300	Alongshore							8	329							
		Cross-shore															
		Resultant															
19	1900	Alongshore															
		Cross-shore															
		Resultant															
20	0100	Alongshore															
		Cross-shore															
		Resultant															
20	0700	Alongshore	25	S													
		Cross-shore	5	On				152	0	0			13	S			
		Resultant	26	171					2	On		North					
20	1300	Alongshore							2	250							
		Cross-shore															
		Resultant															
20	1900	Alongshore															
		Cross-shore															
		Resultant															
21	0100	Alongshore															
		Cross-shore															
		Resultant															
21	0700	Alongshore	30	S													
		Cross-shore	5	On				152	34	S			31	S			
		Resultant	31	169					5	On		North					
21	1300	Alongshore							34	169							
		Cross-shore															
		Resultant															
21	1900	Alongshore															
		Cross-shore															
		Resultant															
22	0100	Alongshore															
		Cross-shore															
		Resultant															
22	0700	Alongshore	15	S													
		Cross-shore	7	On				140	7	N			15	N			
		Resultant	16	184					1	On		South					
22	1300	Alongshore							7	329							
		Cross-shore															
		Resultant															
22	1900	Alongshore															
		Cross-shore															
		Resultant															
23	0100	Alongshore															
		Cross-shore															
		Resultant															
23	0700	Alongshore	4	S													
		Cross-shore	7	On				140	1	N			14	N			
		Resultant	8	222					2	On		South					
23	1300	Alongshore							2	287							
		Cross-shore															
		Resultant															
23	1900	Alongshore															
		Cross-shore															
		Resultant															
24	0100	Alongshore															
		Cross-shore															
		Resultant															
24	0700	Alongshore	4	N													
		Cross-shore	6	On				152	17	N			36	N			
		Resultant	7	279					6	On		South					
24	1300	Alongshore							18	321							
		Cross-shore															
		Resultant															
24	1900	Alongshore															
		Cross-shore															
		Resultant															

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PIER MEASUREMENTS

BEACH MEASUREMENTS:  
(500 UPDRIFT)

DAY:	TIME	PIER MEASUREMENTS				BEACH MEASUREMENTS:							
		DYE AT 19+00 (579m) (SURFACE)		CURRENT METER AT 14+20(433m) I.D.#639 (DEPTH -4.2m MSL)		DYE AT MID-CURF ZONE (SURFACE) DIST. FROM		CURRENT METER AT SOUTH TRIPOD (DEPTH -4.8m MSL) I.D.#677					
		SPEED	DIR	SPEED	DIR	BASELINE (M)	SPEED	DIR	LOCATION	SPEED	DIR	SPEED	DIR
25	0100	Alongshore											
		Cross-shore											
		Resultant											
25	0700	Alongshore	28	N									
		Cross-shore	1	On		152	32	N	South	16	N		
		Resultant	28	337			13	On					
25	1300	Alongshore											
		Cross-shore											
		Resultant											
25	1900	Alongshore											
		Cross-shore											
		Resultant											
26	0100	Alongshore											
		Cross-shore											
		Resultant											
26	0700	Alongshore	21	N									
		Cross-shore	8	Off		152	51	N	South	44	N		
		Resultant	23	2			3	Off					
26	1300	Alongshore											
		Cross-shore											
		Resultant											
26	1900	Alongshore											
		Cross-shore											
		Resultant											
27	0100	Alongshore											
		Cross-shore											
		Resultant											
27	0700	Alongshore	10	N									
		Cross-shore	1	Off		136	41	N	South	51	N		
		Resultant	10	346			22	On					
27	1300	Alongshore											
		Cross-shore											
		Resultant											
27	1900	Alongshore											
		Cross-shore											
		Resultant											
28	0100	Alongshore											
		Cross-shore											
		Resultant											
28	0700	Alongshore	0	0									
		Cross-shore	4	Off		152	41	N	South	19	N		
		Resultant	4	70			6	On					
28	1300	Alongshore											
		Cross-shore											
		Resultant											
28	1900	Alongshore											
		Cross-shore											
		Resultant											
29	0100	Alongshore											
		Cross-shore											
		Resultant											
29	0700	Alongshore	29	S									
		Cross-shore	4	Off		152	11	N	South	17	N		
		Resultant	29	151			0	0					
29	1300	Alongshore											
		Cross-shore											
		Resultant											
29	1900	Alongshore											
		Cross-shore											
		Resultant											
30	0100	Alongshore											
		Cross-shore											
		Resultant											
30	0700	Alongshore	38	S									
		Cross-shore	6	On		152	5	N	South	6	S		
		Resultant	39	168			1	On					
30	1300	Alongshore											
		Cross-shore											
		Resultant											
30	1900	Alongshore											
		Cross-shore											
		Resultant											
31	0100	Alongshore											
		Cross-shore											
		Resultant											
31	0700	Alongshore	38	S									
		Cross-shore	8	On		150	20	N	North	1	S		
		Resultant	39	171			6	On					
31	1300	Alongshore											
		Cross-shore											
		Resultant											
31	1900	Alongshore											
		Cross-shore											
		Resultant											

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## V. SUPPLEMENTAL OBSERVATIONS

Visual wave direction measurements (Table 5) taken at the seaward end of the pier are made of both the primary wave train (i.e. that having the larger wave heights) and the secondary wave train (which must be clearly distinguishable as a wave train separate from the primary waves) but not surface chop or capillary waves. The direction of the primary wave train just north of the seaward end of the pier is also determined using a Raytheon Marine Pathfinder radar and measuring alignment of the wave crests. The pier axis (considered perpendicular to the beach at the FRF) is orientated 70 east of true north; consequently, wave angles greater than 70 imply the waves were coming from the south side of the pier.

The width of the surf zone (seawardmost breaker position to shoreline) is determined from the pier deck.

Measurements of surface water temperature, density, and visibility are made daily at the seaward end of the FRF pier. A jar along with a thermometer is lowered about .3 m (1 ft) into the water and allowed to remain for at least one minute. The jar is removed, the temperature read and a hydrometer is used to determine the density. A secci disc is used to determine the surface visibility.

Table 5

## SUPPLEMENTAL OBSERVATIONS

July 1986

DAY/TIME	WAVE APPROACH ANGLE AT PIER END (° from True N)		RADAR WAVE ANGLE (° from True N)	WIDTH OF SURF ZONE (M)	WATER CHARACTERISTICS AT PIER END		
	PRIMARY	SECONDARY			TEMP (°C)	DENSITY (g/cc)	SECCI VIS (M)
1 0710	80			23	21.1	1.0233	5.2
2 0710	105			15	20.0	1.0234	3.4
3 0705	45			17	21.0	1.0232	5.5
4 0805	80			23	23.2	1.0223	6.1
5 0735	130			14	23.6	1.0210	4.6
6 0920	110			14	23.9	1.0214	3.7
7 0710	110			8	20.6	1.0230	3.0
8 0705	105			5	24.7	1.0188	5.2
9 0705	100			4	21.5	1.0211	5.2
10 0700	45			9	24.2	1.0210	6.1
11 0705	95			5	24.2	1.0209	5.8
12 0705	150			12	22.1	1.0229	4.9
13 0700	160			15	17.2	1.0242	5.5
14 0715	105			12	18.8	1.0234	6.1
15 0615	70			6	19.3	1.0232	6.1
16 0700	90			12	25.5	1.0213	6.1
17 0700	100			5	22.7	1.0226	4.9
18 0700	100	130		7	26.9	1.0207	5.2
19 0745	80			7	28.2	1.0202	5.8
20 0855	85			5	27.3	1.0203	5.2
21 0700	95	50		10	27.4	1.0200	4.9
22 0710	95			9	27.5	1.0204	5.2
23 0700	105			7	27.0	1.0201	4.6
24 0705	95			15	27.0	1.0205	4.0
25 0705	115			16	22.3	1.0203	4.0
26 0645	120			23	20.0	1.0220	4.0
27 0845	140			34	18.1	1.0238	4.0
28 0705	110	125		10	18.3	1.0240	3.7
29 0620	135			7	22.0	1.0218	4.3
30 0705	115	60		12	21.6	1.0222	6.1
31 0725	125			9	23.2	1.0217	6.1

## VI. WATER LEVELS

The National Ocean Services (NOS) has established a primary tide station (No. 865- 1370) at the seaward end of the FRF pier. A Leupold-Stevens digital recording float-type tide gage is used to collect data every 6 minutes throughout the month.

Figure 4 shows the variation in mean water levels computed over a tidal cycle period (12.42 hours), and contains a list of selected mean and extreme values. This presentation is useful in identifying effects on both meteorological and astronomical forces on the open coast water levels.

Table 6 contains the time of the center of each sampling interval and the range, high, low, and mean water levels during each tidal cycle.

## FRF TIDE HEIGHTS

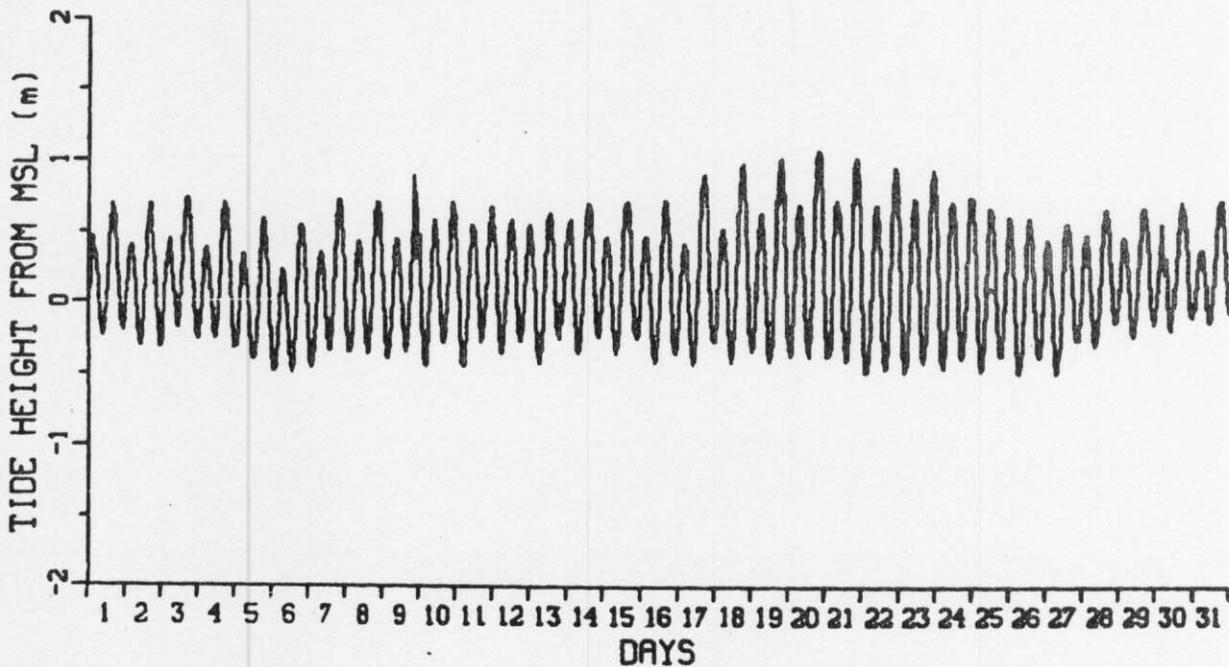


FIGURE 5. Time History of Mean Water Levels, July 1986 (Gage No. 865-1370)

### MONTHLY MEAN WATER LEVELS (METERS MSL)

Extreme Low -	-.48 on 26 July at 0500 hrs.
Extreme High -	1.08 on 20 July at 1830 hrs.
Monthly Mean -	.15
Mean Low Water -	-.33
Mean High Water	.64
Mean Range -	.97

TABLE 6  
WATER LEVELS (METERS MSL)  
 Tidal Characteristics

July 1986

MID-CYCLE DAY	TIME	LOW	HIGH	MEAN	RANGE
1	612	-0.23	0.46	0.12	0.70
1	1837	-0.20	0.69	0.24	0.89
2	703	-0.30	0.41	0.08	0.70
2	1928	-0.31	0.70	0.18	1.01
3	753	-0.17	0.46	0.16	0.63
3	2018	-0.25	0.75	0.25	1.00
4	843	-0.26	0.40	0.09	0.66
4	2109	-0.31	0.71	0.19	1.02
5	934	-0.39	0.35	-0.02	0.74
5	2159	-0.47	0.60	0.04	1.07
6	1024	-0.47	0.24	-0.08	0.71
6	2249	-0.45	0.56	0.05	1.01
7	1115	-0.34	0.45	0.06	0.78
7	2340	-0.34	0.73	0.17	1.06
8	1205	-0.34	0.48	0.08	0.82
9	30	-0.38	0.71	0.14	1.09
9	1255	-0.33	0.48	0.09	0.80
10	121	-0.43	0.90	0.15	1.33
10	1346	-0.27	0.58	0.17	0.85
11	211	-0.44	0.70	0.12	1.14
11	1436	-0.27	0.55	0.17	0.82
12	301	-0.34	0.68	0.14	1.02
12	1527	-0.25	0.58	0.16	0.83
13	352	-0.41	0.55	0.06	0.97
13	1617	-0.24	0.63	0.21	0.87
14	442	-0.35	0.58	0.11	0.93
14	1707	-0.23	0.69	0.21	0.92
15	532	-0.34	0.56	0.09	0.90
15	1758	-0.25	0.71	0.21	0.96
16	623	-0.41	0.47	0.05	0.88
16	1848	-0.34	0.73	0.16	1.07
17	713	-0.47	0.57	0.04	0.95
17	1938	-0.27	0.90	0.28	1.16
18	804	-0.41	0.55	0.10	0.96
18	2029	-0.34	0.98	0.30	1.31
19	854	-0.40	0.63	0.14	1.03
19	2119	-0.37	1.01	0.31	1.38
20	944	-0.37	0.70	0.20	1.07
20	2210	-0.37	1.08	0.33	1.44
21	1035	-0.39	0.72	0.18	1.11
21	2300	-0.48	1.01	0.26	1.49
22	1125	-0.45	0.69	0.12	1.14
22	2350	-0.47	0.94	0.23	1.42
23	1216	-0.41	0.73	0.16	1.14
24	41	-0.45	0.94	0.22	1.39
24	1306	-0.38	0.70	0.17	1.08
25	131	-0.46	0.75	0.14	1.21
25	1356	-0.36	0.67	0.14	1.03
26	222	-0.48	0.61	0.05	1.09
26	1447	-0.36	0.60	0.09	0.96
27	312	-0.48	0.45	-0.01	0.93
27	1537	-0.25	0.56	0.16	0.81
28	402	-0.29	0.49	0.11	0.78
28	1628	-0.12	0.67	0.26	0.79
29	453	-0.23	0.47	0.14	0.69
29	1718	-0.13	0.69	0.27	0.82
30	543	-0.17	0.56	0.17	0.73
30	1808	-0.08	0.72	0.30	0.80
31	634	0.12	0.39	0.17	0.52

## VII. NEARSHORE PROFILES

A. Nearshore Profiles. In order to document profile response away from the pier, surveys of four profile lines extending 900 to 1,000 m from shore and located 489 and 581 m north and 517 and 608 m south of the FRF pier are conducted bi-weekly, after storms, and during more complete bathymetric surveys.

These profiles are obtained using the CRAB-Zeiss surveying system; a Zeiss Elta-2 first-order, self-recording electronic theodolite distance meter in combination with the Coastal Research Amphibious Buggy (CRAB), a 10.7 m high, self-powered, mobile tripod on wheels.

Figure 5 shows the last survey in June and the two surveys in July on profile line 188, located 517 m south of the pier. Due to the very mild wave conditions during July, the only significant changes to the profile are the development of a berm (80 to 120 m) and the removal of the small nearshore bar.

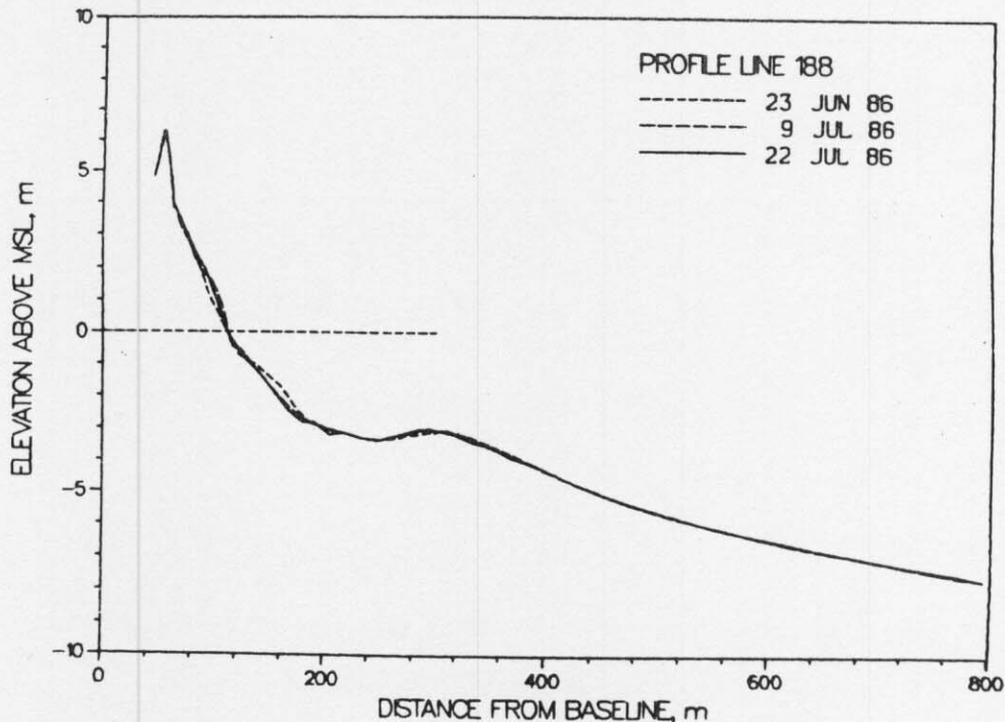


Figure 5. Monthly CRAB profiles on profile 188 - 517 meters south of pier.

The profile envelope (Figure 6) reflects the maximum changes which occurred on the profile between January and July. There were no changes to the envelope during July.

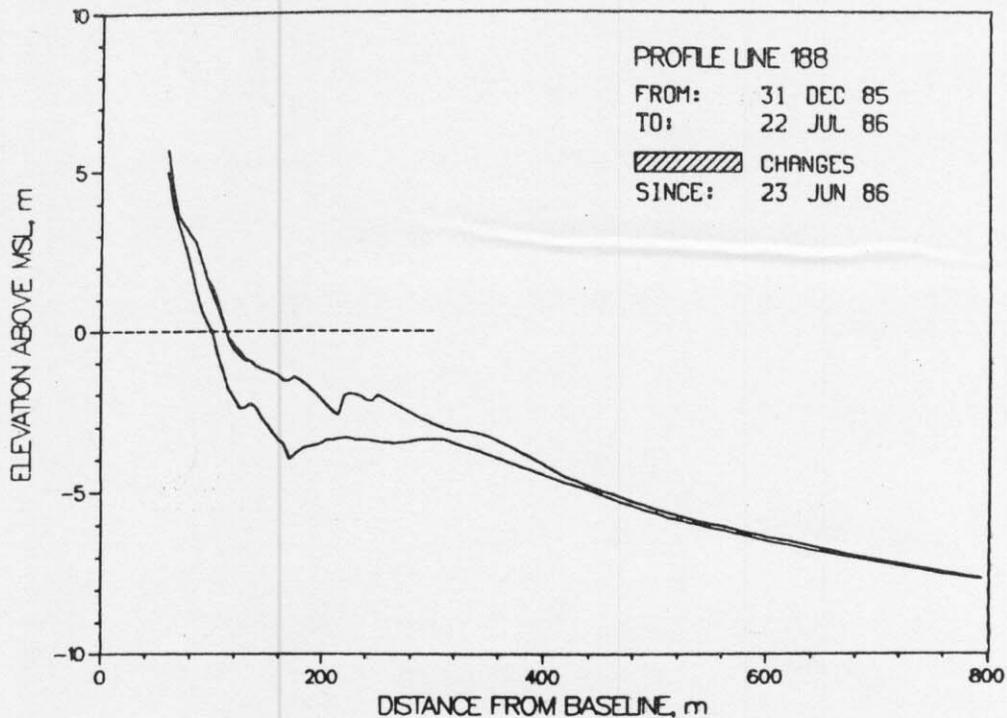


Figure 6. CRAB profile envelope - profile 188.

B. Bathymetry. This month's bathymetric survey (Figure 7), completed on 11 June, shows a rhythmic variation of the -2 m contour north of the pier, with otherwise typical summer bathymetric contours. The trough under the pier is rather narrow with some elongation of the -3 and -4 m depths to the south, generally an indication that recent waves from the north influenced the bathymetry.

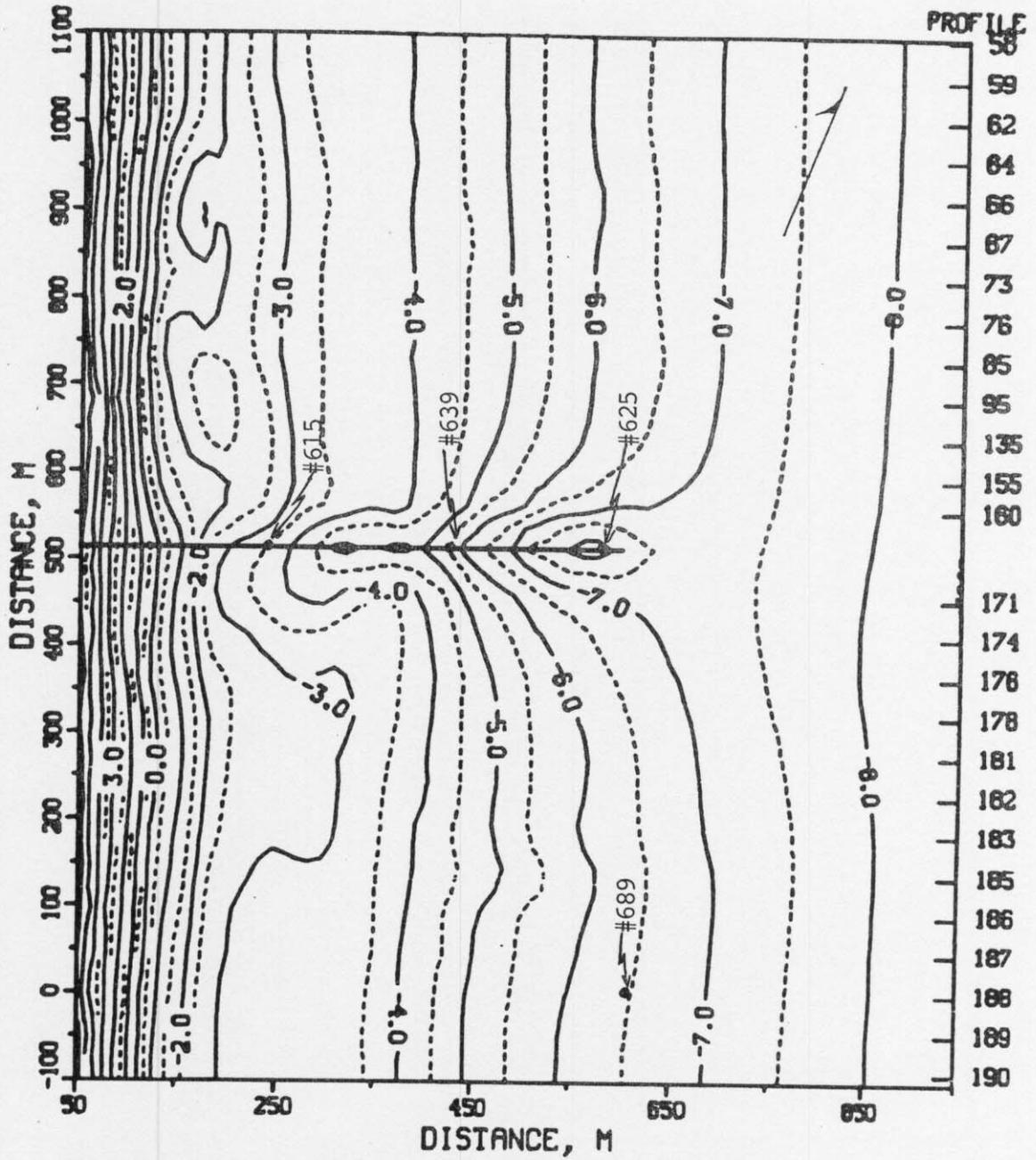


Figure 7.

FRF BATHYMETRY 23 JUL 86  
 CONTOURS IN METERS



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